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ABSTRACT

Designed to serve as a resource for school districts, this manual focuses on new applications of the information technologies that are available for use in education. The first of four chapters presents a statement of the values, philosophy, mission, and goals of the Minnesota State Board of Education. An outline of learner goals and objectives is included. The second chapter begins with an overview of the issues involved, research findings, new skills, the current state of technology in schools, and technology as a learning tool. Brief statements are then presented on individual technologies, including computer-assisted instruction, databases, word processing, multimedia and hypermedia, and other uses of microcomputers. Brief discussions of related issues such as business and industry needs, access to information, and school restructuring conclude this chapter. A model of learner outcomes related to information technology is listed in the third chapter, with an emphasis on technological literacy. The final chapter discusses the integration of technology into the educational process, including modifications and extensions for special populations and guidelines for developing an action plan. (33 references) (DB)

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# Model Learner Outcomes for Information Technology Education

## Curriculum Integration Guide

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Minnesota Department of Education

1991

# Model Learner Outcomes for
# Information Technology Education

## Curriculum Integration Guide

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# Minnesota State Board of Education

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# Preface

***It became apparent that a few scattered classes in programming and computer literacy, as well as a lack of instruction in other applications of information technology, would soon leave our graduates woefully unprepared for the modern world.***

***Dr. Charles Sambs***

In the past, schools used information technology mainly for drill, practice, and educational games. This type of use is still common in many schools today. But information technology offers much more than flickering screens of high resolution worksheets. Technology gives students and teachers power to do things they have never been able to do before, except in their imaginations.

This document focuses on these new applications of information technology available for use in education. It serves as a resource for school districts as they:

1. develop a philosophy for new uses of information technology in education
2. write information technology learner outcomes
3. design a plan for integrating information technology outcomes into the curriculum.

It is time to take the next step; time to go beyond using technology as only electronic workbooks. Schools need to develop a new vision for the role information technology can play in transforming and improving education. This document outlines that new vision and provides suggestions for taking the steps needed to make that vision a reality.

John See, Specialist
Technology Integration

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# Chapter 1

# Minnesota State Board of Education

**Values, Philosophy, Mission, and Goals**

**Education System Values**

**Learner Values**

**Philosophy of the Minnesota State Board of Education**

**Mission for Public Education**

**Mission of the Minnesota State Board of Education**

**Mission of the Minnesota Department of Education**

**Minnesota State Board of Education Learner Goals**

# Values, Philosophy, Mission, and Goals

School districts nationwide, and certainly in Minnesota, are constantly striving to improve the learning experiences they provide students. The last two or three decades have seen heightened interest in improving all parts of the education process, including appropriate involvement of students, parents, and the community at large.

The documents that constitute the Minnesota Department of Education's *Coordinated Model for Educational Improvement* incorporate many of the concerns expressed and issues addressed by the public, Legislature, and in reports on the state of public education. One of these documents, titled *Goal and Outcome Specification Process*, suggests a set of procedures for appropriate involvement of the public. These procedures include public participation on the development of statements of values, philosophy, mission, and learner goals. These sets of statements are a hierarchy of increasingly specific concepts ranging from values, the most general, to learner goals, the most specific, that give form and direction to public education. Given this hierarchy, staff skilled in subject matter and the profession of teaching can develop very specific learner outcomes for each subject area.

The following sets of statements were adopted by either the Minnesota State Board of Education or the Minnesota State Legislature for two purposes. First, they provide a model for use by communities and school staff as they strive to improve the learning experiences they provide for residents. Second, they are the hierarchy used by Department staff and teams of educators as they develop model learner outcomes for each subject area. The *Mission Statement for Public Education* adopted by the Legislature gives explicit direction to public schools. The State Board Curriculum Rule 3500.1060 adopted February 1990 lists the learner goals which must be incorporated into each district's goal statements. All other parts of this document are models, suggestions for the consideration of residents and professionals in each district.

## Education System Values

We believe the following values are pre-eminent for the education system. These attributes are to be reflected in all educational programs and operations.

**ACCOUNTABILITY** - A condition in every school whereby each is able to justify its use of public resources by effectively fulfilling its mission of learning.

**EFFECTIVENESS** - A condition in every school whereby each accomplishes its mission at a performance level defined by learners, parents, citizens of the community and state, and their representatives.

**EFFICIENCY** - A condition in every school whereby each accomplishes the highest possible level of excellence with available resources.

**EXCELLENCE** - A condition in every school whereby the highest possible standards for performance are expected of all students and staff.

**FLEXIBILITY** - A condition in every school which results in meeting the needs of learners through sensitive and creative responses to changing circumstances.

**HUMAN EQUITY** - A condition in every school which offers equal opportunity and appropriate individualized support to each staff member in employment and professional growth and to each learner in the educational process. Also, a condition which, fully, fairly, and accurately portrays various cultures, races, and genders in the instructional program.

**RESPONSIBILITY** - A condition in which the school recognizes that the parent has primary responsibility to assure the child is educated, and in which a partnership exists between the school, community, parent, and the learner to identify the learning goals and needs of the child or adult learner and provide appropriate learning opportunities through which those goals can be met.

**RESPONSIVENESS** - A condition in every school whereby diversity of personal and group needs and aspirations are expected, accepted, encouraged, and routinely addressed.

**SYSTEM EQUITY** - A condition in the education system whereby each school is provided with the resources necessary to assist all learners in achieving excellence.

**WHOLENESS** - A condition in every school whereby each gives necessary and appropriate consideration to the potential career needs, spiritual, social, emotional, and physical growth of each learner and staff member as it designs and implements educational programs.

**VISIONARY** - A condition in the education system whereby emerging trends which will affect the knowledge and skills required to be a successful adult are examined and the knowledge gained is used to produce appropriate changes in the system's course content, procedures, and goals for learners.

## Learner Values

We believe helping students develop the following values is a primary purpose of education.

**ACCOUNTABILITY** - A quality in individuals whereby each knows, understands, and accepts the impact and consequences of personal actions and decisions.

**CITIZENSHIP** - A quality in individuals whereby each has an understanding, appreciation, and support of the institutions of American government and society and a willingness and ability to participate in the democratic process and in socially beneficial service activities.

**COMPASSION** - A quality in individuals whereby each is sensitive to the conditions affecting the lives of others and each has the commitment to assist others when appropriate and possible.

**COMPETENCE** - A quality in individuals whereby each attains maximum levels of knowledge, skill and affect commensurate with his or her potential.

**COOPERATIVENESS** - A quality in individuals whereby each interacts with others in a manner that mutually benefits all participants in the interaction.

**CREATIVITY/FLEXIBILITY** - A quality in individuals whereby each acts or expresses self in new, improved, or unique ways.

**ETHICS** - A quality in individuals whereby each displays consistent personal and professional integrity and an acceptance of the responsibility to act for the benefit of all learners.

**HONESTY** - A quality in individuals whereby each is fair and straightforward in the conduct of human interaction.

**LEARNING** - A condition in individuals whereby each continually strives throughout life to learn more and to increase personal levels of fulfillment and competence in human endeavors.

**PROBLEM SOLVING** - A condition in individuals whereby each has the ability to identify, frame, and propose new, improved, or unique solutions to existing and emerging problems.

**RESPONSIBILITY** - A quality in individuals whereby each strives to fulfill the obligations of economic self-sufficiency and active commitment to the common good of society.

**SELF-ACCEPTANCE** - A quality in individuals whereby each has a positive self-image, through assertion of rights, holding personal, physical, and emotional well-being as an ideal, accepting personal talents with humility, and personal limitations with the resolve to improve where possible and accept where necessary.

**SPIRITUALITY** - A quality in individuals whereby each recognizes and accepts the importance of nurturing one's inner spirit, that creative force that transcends the human and the material.

**THINKING** - A condition in individuals whereby each continually strives to improve personal skills for mental manipulation of sensory perceptions to form knowledge, thoughts, reason, and judgments.

## Philosophy of the Minnesota State Board of Education

We believe...

... Every person can learn.

... Learning is a lifelong process.

... Every person must understand and accept self before he or she can become a contributing member of society.

... Each person has gifts which the education program must seek, identify, and help to maximize.

... Advancement of the human race requires individuals who are honest, responsible, compassionate, cooperative, creative, and competent.

... The state and local communities have a shared responsibility to assist each person in learning.

... Each community has a shared responsibility with parents for meeting the needs of each child.

... The community and its school system must continually look to and strive to meet the future education needs of society.

... The education system must assist each person to become functional in an increasingly global and interdependent world.

... The education system must lead people to value and accept a wide diversity in human behaviors, sophistication, and values.

... The education system must maintain high standards for responsiveness, human equity, and system equity in the provision of educational opportunities.

... Decisions regarding planning, implementing, and maintaining learning opportunities must be vested as close to the individual learner as efficient use of public resources allow.

... School systems must implement programs that stress the intellectual development of each learner in concert with the spiritual, social, emotional, and physical development of the learner.

... School systems must model and nurture creativity in learners. Staff employed in schools must model the behaviors they are assisting learners to develop.

... School systems must maintain opportunities for all learners to develop competence in personally selected areas of human development.

... Professional educators have a responsibility to remain current with evolving knowledge about human growth and development, learning theory, and knowledge of subject matter.

... Professional educators and elected or appointed education policymakers have a responsibility to account to the public for the excellence of their efforts.

... Professional educators and elected or appointed education policymakers have a responsibility to use public resources prudently and efficiently.

## Mission for Public Education

The purpose of public education is to help individuals acquire knowledge, skills, and positive attitudes toward self and others that will enable them to solve problems, think creatively, continue learning, and develop maximum potential for leading productive, fulfilling lives in a complex and changing society. *As enacted into law, Chapter 240, Laws of 1985, by the Minnesota Legislature.*

## Mission of the Minnesota State Board of Education

The Minnesota State Board of Education will provide the vision, advocacy, and leadership to improve significantly the quality of education throughout the state.

## Mission of the Minnesota Department of Education

The Minnesota Department of Education provides leadership, service, and regulation to maintain and improve an equitable, uniform and quality system of public education for all learners.

The Department provides leadership as an advocate for education by defining quality education and by seeking the resources necessary to meet the needs of all learners.

The Department provides service through informational and technical assistance that will improve the productivity and performance of students and staff, and provide opportunities for the development of the potential of all learners.

The Department regulates education by maintaining, interpreting, and enforcing Minnesota State Board of Education rules, and state and federal laws.

## Minnesota State Board of Education Learner Goals

The following learner goals are a general statement of the purpose for education, they describe the type of person who would graduate from a Minnesota school and are a model for local goal adoption.

A. To effectively participate in learning activities, each learner will master:

1. Reading literacy to gather information and data, gain perspective and understanding, and as a leisure activity;
2. Writing to explain, describe, and express a point of view and feelings;
3. Listening to gather information and data and gain perspective and understanding;
4. Speaking to explain, describe, express a point of view and feelings, and to discuss an issue;
5. Numerical literacy to apply arithmetic functions to life situations;
6. The use of a variety of tools, including electronic technology, to enhance learning;
7. Viewing and observing to gather information and data, gain perspective and understanding;
8. Self-expression through visual and performing arts.

B. To provide a foundation for meaning in life, each learner will accumulate and apply knowledge and develop the understanding:

1. To participate in lifelong learning;
2. To live successfully within local, state, national, and world political and social structures;
3. To examine personal beliefs and values and their relationship to behavior;
4. To make ethical and moral decisions;
5. To be a responsible citizen of the community, nation, and the world;
6. To practice stewardship of the land, natural resources, and environment;
7. To know the impact of human life on nature and the impact of natural phenomena on human life;
8. To express self through artistic creation;

9. To know career options and the general education requirements for each;

10. To know world and national economic conditions to make informed decisions on consumer products, occupations, career needs, and use of resources;

11. To select or prepare for a series of occupations which will personally satisfy and suit one's skills and interests;

12. To manage personal affairs;

13. To communicate and relate effectively in a language and about a culture other than one's own;

14. To know the importance of geographic location in the functioning of contemporary society.

C. To think, decide, resolve issues, and meet needs creatively, each learner will be able to:

1. Compare, differentiate, relate information and facts, and apply knowledge;

2. Combine various facts, situations, and theories to formulate hypotheses or develop solutions;

3. Critique and make judgments about materials, conditions, theories and solutions;

4. Generate and value creative alternatives;

5. Create musical, visual, and verbal images, and movement as a means of self-expression.

D. To value, understand, and accept human interdependence, each learner will be able to:

1. Seek interactions and feel comfortable with persons who are different in race, religion, social level, or personal attributes;

2. Understand the interrelationships among complex organizations and agencies in modern society;

3. Understand society's responsibility for dependent persons of all ages in a manner consistent with the growth and development needs of those persons;

4. Understand how the citizens of the United States are geographically and socially connected to people and places in other parts of the world.

E. To value, understand, and accept the diversity of humankind, each learner will be able to:

1. Base actions and decisions on the knowledge that individuals differ in many ways;

2. Base actions and decisions on the knowledge that values and behaviors differ from one social group to another;

3. Base actions and decisions on the understanding that lifestyles and behaviors reflect the value system of the society in which they were learned;

4. Judge other's actions with an understanding of the personal and social context of that action;

5. Understand people of other cultures through their visual and verbal arts, music, and creative movement;

6. Accept that there is more than one way of being human;
7. Base actions and decisions on the understanding that as individuals move from one society to another, they can learn lifestyles and can learn to behave appropriately in different societal contexts;

8. Act on the belief that human behavior is influenced by many factors and is best understood in terms of the context in which it occurred.

F. To address human problems through group effort, each learner will develop the knowledge, skills, and affect essential to:

1. Act in accordance with a basic ethical framework incorporating the values which contribute to successful community life such as honesty, fairness, compassion, and integrity;

2. Understand the importance of working in groups to achieve mutual goals;

3. Be able and willing to provide leadership in resolving personal and societal issues.

G. Each learner will be able to effectively resolve conflicts with and among others by:

1. Assuming responsibility to form productive and satisfying relationships with others based on respect, trust, cooperation, consideration, and caring for other persons;

2. Acting on the belief that each individual has value as a human being and should be respected as a worthwhile person;

3. Resolving conflict in the manner most beneficial to society.

H. Each learner will be able to act on contemporary events and issues with a perspective of their historical origin by:

1. Understanding the origin, interrelationship, and effect of beliefs, values, and behavior patterns on world cultures;
2. Understanding one's own culture and historical heritage through the political, literary, aesthetic, and scientific traditions of the past;
3. Being familiar with the ideas that have inspired and influenced humankind;
4. Understanding the manner in which heritages and traditions of the past influence the direction and values of society.

I. Each learner will develop a positive attitude toward self demonstrated through:

1. A feeling of positive self-worth, security, and self-assurance;
2. A willingness to live with one's strengths and weaknesses;
3. A knowledge of one's own body and a positive attitude toward one's own physical appearance;
4. Understanding that efforts to develop a better self contribute to the development of a better society;
5. Understanding that self-concept is acquired by interaction with other people;
6. Appropriate control or release of emotions.

J. To set and achieve personal goals, each learner will develop the ability to:

1. Select appropriate personal learning goals;
2. Make decisions about one's life;
3. Plan, organize, and act to realize one's goals;
4. Accept responsibility for personal decisions and actions;
5. Work now for goals to be realized in the future;
6. Select viable alternatives for action in changing circumstances.

K. To cope with change, the learner will have the ability to:

1. Initiate appropriate change while respecting existing structures and concepts;

2. Tolerate ambiguity;

3. Understand that coping with change is a lifelong process;

4. Understand and accept the changing nature of work and the potential need to change careers several times;

5. Use career information and counseling services to make informed and satisfying vocational choices.

L. To lead a healthy, fulfilling life, each learner will:

1. Assume responsibility for one's own physical and mental health and safety by establishing a daily regime of positive behaviors which will maintain mental and physical health, and motor fitness;

2. Make informed decisions about health products and services;

3. Make a lifestyle which promotes healthful family living;

4. Understand public health measures and their effect on the individual, family community, and the environment;

5. Be able to enjoy play-skill activities which include understanding, cooperation, accepting rules, controlling emotions, following group process, and acquiring self-satisfaction.

M. To lead a productive life and actively contribute to the economic well-being of our society, each learner will develop the work readiness skills of:

1. Applying the basic skills of communications, computation, and scientific principles to real-life situations in a technological society;
2. Defining and interpreting the nature of the work force in terms of one's own challenges and opportunities;

3. Leadership and citizenship skills necessary to succeed as an active agent in a changing work force;

4. Understanding employment opportunities, job seeking and keeping skills, and specific work skills as they relate to transition from school to economic productivity;

5. Developing pride in good work and expecting quality in products and services;

6. Adopting a positive attitude toward work, including an acceptance of the necessity of making a living and an appreciation of the social value and dignity of work.

# Chapter 2

# Technology in Education

## Introduction

### Issues Considered

## What the Research Says

### New Skills for a Post Industrial Age
### The State of Technology in Schools Today
### Technology as a Learning Tool
### Technology in Minnesota Schools
### Business and Industry Needs
### Implications for Education

## Transforming and Restructuring Schools

### Beyond Electronic Workbooks

# Introduction

***Information technology is any electronic tool which allows its user to store, access, process, create, and communicate information.***

## Issues Considered

This document represents thinking based on information available today. Since information technology is rapidly improving and changing, any plan developed should be subject to continuous review and modification.

The following issues were also taken into consideration in the development of this publication:

Information technology skills are best taught by integrating them into the existing curriculum. Technology should be a tool used to increase learning options for all students. Simply stated, students understand, use, and appreciate technology while they use technology to learn.

Equity of access to information, and the technology which stores it, should be a basic right in our society. Efforts must be made to ensure that information technology and its applications are made available to all socio-economic levels in metropolitan and greater Minnesota, including women, people of diverse cultures, and individuals who are physically or mentally challenged. While not everyone will work in a "high-tech" job, every person's life and occupation will be affected by technology. The inability to understand, use, and appreciate information technology will be a handicap which could affect the fulfillment of any individual's personal and professional goals.

Considerable effort must also be made to ensure that students learn and use higher-level thinking applications of technology. The potential of information technology cannot be fulfilled unless students are taught to understand, use, and appreciate information technology's role in real-life problem solving and decision making.

## New Skills for a Post Industrial Age

John Naisbett gained public attention in 1982 with his best-selling book, *Megatrends*. Naisbett noted rapid increases in the quantity and capability of technology which allows the storage and flow of large amounts of information. This technology is both the cause and facilitator of the transition to our information age which requires new skills of learners.

In a 1982 address to the National Conference on Communications Technology and Training, an in-house consultant for the United States Office of Technology Assessment warned of "major changes that will occur in the workplace, in manufacturing procedures, occupational structures and occupations in demand as a result of the use of technology." The comments were based on developments and trends in information technology which included computers, video disc, and satellite transmission. (Information Dynamics, Inc. 1982)

In the 1983 publication *A Nation At Risk*, the National Commission on Excellence in Education also noted that the changing nature of the job market required new information skills. The report also stated that "computers and computer-controlled equipment are penetrating every aspect of our lives, homes, factories, and offices."

A 1988 publication of the federal government, *Meeting Public Demands: Federal Services in the Year 2000*, supports those earlier predictions. This document reported a significant increase in the number of American workers employed in service and information sectors of the economy. The report also noted that computers, interactive television, and other information technologies are increasingly affecting the entire population.

It appears that electronic ways of communication, information collection and retrieval, transfer of funds, and many other electronic information activities will be the norm rather than the exception at home, work, and even education.

Naisbett was not alone in his belief that skills for our information age differ from the skills for the industrial age. Findings by agencies of the federal government agree with and lend support to Naisbett and others who predicted the emergence of an information society. These predictions have also been validated, at least in part, by today's news accounts of factory closings, layoffs for assembly line workers, and breakthroughs in technology.

## The State of Technology in Schools Today

*Power On!*, published by the United States Office of Technology Assessment in 1988 reported dramatic increases in numbers and kinds of information technology in American schools. *Electronic Learning's Eighth Annual Survey* of information technology in the nation's schools supports the findings reported in *Power On!* CD-ROMs, modems, VCRs, and video disc players have appeared in increasing numbers. (Bruder 1988)

The use of technology in education does not appear to be ending. In fact *Power On!* called for increased use of technology in the nation's schools. Other committees and organizations have echoed these recommendations for more funding, training, and research to support the most effective uses of technology in education. School reformers have also called for increased availability of technology in schools to support their agendas for student-centered learning, empowered teachers, and improved methods of tracking and assessing student progress. (Goldberg 1988, Pearlman 1989)

It appears that many state educational agencies have responded to calls for increased staff development and availability of information technology in the nation's schools. *Electronic Learning's Eighth Annual Survey* revealed that seventy-five percent of the states planned to start new technology programs in 1989. A large number of these initiatives focused on distance learning, CD-ROM, video disc, and computer tools for teachers and students. (Bruder 1988)

School districts, schools of education, state education agencies, and private companies have also allocated resources for training teachers to use new technology in the classroom. However, research indicates that the level of training has been minimal at best. (Glenn and Carrier 1987) Perhaps the problem has been with the staff development design. Too often technology staff development activities are short-term and focus on the technology itself. Technology staff development efforts need to be long-term and stress integration of technology applications into the curriculum. (Valdez 1989)

## Technology as a Learning Tool

Has technology made a difference in education? The question is not easily answered. First, most of the existing research was conducted with students interacting with computers. Although a number of studies are now underway to determine the effects of interactive video, telecommunications, and other technologies, there is no large or conclusive body of research dealing with newer forms of information technology.

A substantial portion of research relating to information technology was conducted prior to 1983. This research may have little relevance for today since most of it studies the use of mainframe computer systems in computer programming and drill and practice. Besides being outdated, a substantial portion of existing research suffers from methodology problems. (Becker 1988, Roblyer 1988, Bracey 1988, Bracey 1989)

If much of the research is flawed and outdated, then what is known? The following results were taken from research which considered only projects which met certain minimum criteria for size, length of time, methodology, and relevance. (ERIC Digest 1989)

**Computer Assisted Instruction (CAI)**

Tutorials and drill and practice are the most researched applications of computer technology. Recent studies have consistently reported positive results. It has been demonstrated to be an effective supplement to traditional classroom instruction, particularly in elementary-age children. CAI appears to be less effective at the high school level and least effective at the college level. CAI may be more effective for low-achieving students than for average and high-ability students. (Capper 1988, OTA 1988, Bracey 1987)

**Computer Programming**

Studies on the effects of teaching programming to enhance analytic skills have produced mixed results. There is some limited evidence that learning to program develops basic thinking abilities. Much of high school computer use was limited to programming, which prevents integration of computer applications into the total curriculum or hinders its use as a personal productivity tool for teachers and students. (OTA 1988)

**Databases, Spreadsheets, and Simulations**

Computer applications, particularly simulations, in science and math have yielded higher effects than in any other area. Probes, measurement tools attached to a computer, and databases used in scientific experiments have been shown to help students master important analytical techniques, although the skill of the teacher is a critical factor. Results of studies where students use the computer to develop graphing skills are more consistently positive than any other area of computer use. (Roblyer 1988)

**Word Processing and Desktop Publishing**

Early predictions that the use of computers for word processing and desktop publishing would improve the quality of writing do not seem to hold up in the research. Rather, studies have consistently shown that students want to write more and feel more positive about their writing when word processing and desktop publishing applications can be used as part of the writing process. (Roblyer 1988) The way to become a better writer is to write more. Word processing supports student desire to write more and in the process become better writers.

**Multimedia, Desktop Presenting, and Hypermedia**

Multimedia programs are being developed at a rapid rate, but little research exists to document their effectiveness. One of the first widely available multimedia programs was *Voyage of the Mimi.* All teachers involved in the field test reported a positive response to the materials, indicated their intent to use them again, and recommended the materials to other teachers.

New applications such as hypermedia, desktop presenting, and interactive video are now being studied. Early results seem to suggest that these applications of technology seem even more useful in providing meaningful learning experiences than earlier uses of computers such as drill and practice. (OTA 1988)

**Logo and Robotics**

Logo and robotic applications in problem-solving and general thinking skills were found to make a significant difference and show promise as a method of improving cognitive skills. (ERIC Digest 1989)

*Confronted with a technological revolution transforming the rest of society, schools can cling to traditional formsand ways of operating...*

*...but only at the cost of becoming ever more alienated, obsolete, and ultimately irrelevant to that society.*

*Lewis Pearlman*

## Technology in Minnesota Schools

Minnesota's information technology efforts began in the early 1970s with the creation of the Minnesota Educational Computing Consortium (MECC). MECC provided computer services to schools, including teacher training, and software evaluation and development.

Technology demonstration sites funded by the Minnesota State Legislature from 1983 to 1987 stressed effective uses of a variety of information technology including computers, interactive television, CD-ROM, video discs, video production, robotics, and CAD-CAM systems.

In 1985 the Minnesota State Legislature adopted an educational mission statement. This statement has served as a guideline for efforts of the Minnesota Department of Education, the Minnesota Board of Education, and subsequent legislative initiatives. The statement reads:

**The purpose of public education is to help individuals acquire knowledge, skills, and positive attitudes toward self and others that will enable them to solve problems, think creatively, continue learning, and develop maximum potential for leading productive, fulfilling lives in a complex and changing society.**

The statement implies the need for students to acquire new skills needed to cope with an increasingly technological society where information is accessed, managed, and communicated in a variety of electronic and visual formats.

Further evidence of Minnesota's commitment to preparing students to understand and effectively use technology can be found in learner goals adopted by the Minnesota State Board of Education. Mastery of electronic technology as a learning tool is specifically addressed. Mastery of many other skills, such as information gathering and communication requires knowledge, appreciation of, and comfort using information technology.

In 1988, *Power On!* identified Minnesota as one of only five states reporting a student to computer ratio lower than 24 to 1 as a state-wide average. In 1989, the estimated ratio was 17 to 1.

More recently, the Minnesota State Board of Education adopted rules mandating learner outcomes for information technology be integrated into other curriculum areas and not taught in isolation as a stand alone subject.

## Business and Industry Needs

Business and industry representatives have stated high school graduates must be able to function as members of new organizations in the working world. In order to do so, graduates must have well-developed thinking skills and be able to:

1. take informed action
2. make informed decisions
3. effectively communicate
4. efficiently solve problems
5. be flexible thinkers
6. use technical tools and applications.

Business representatives also state, "It seems there are at least two levels of computer usage that we deal with in society. There is a level that deals with computers as scientific tools that can extend the boundaries of what we know about the world in the scientific sense. There is also the level of using computers to replace other tools (typewriters, telephones) in doing the ordinary tasks of life in more convenient or more efficient ways. Students need different levels of skill to use technology in each of these ways.

"For the average citizen, it is sufficient to be able to communicate with a computer, to get it to do what you want or need to have done, and to get the task accomplished in a shorter period of time, or more efficiently, or even do something that couldn't be done before." In other words, today's graduates must be technologically literate.

## Implications for Education

The past decade has seen computers, satellite dishes, and VCRs become ordinary tools for many members of today's society. Word processing, telecommunications, databases, and CD-ROM are used routinely in the workplace. Information technology has become the primary means of information storage, access, processing, and communication in our society.

What does this transformation from an industrial society to our information society mean for education? If the nature of society has changed, then clearly the skills required to live successful and fulfilling lives have also changed. In identifying the risk to the nation, the National Commission on Excellence in Education quoted educational researcher Paul Hurd, who stated "We are raising a new generation of Americans that is scientifically and technologically illiterate." The commission pointed out the need for a new basic skill called technological literacy.

The Minnesota Task Force on Education for Employment concluded, in 1988, that all students must be taught work readiness in a fully integrated curriculum. Work readiness includes the skills, basic knowledge, attitudes, values, and behaviors necessary to succeed in the working world. Technological literacy is among the skills specifically identified by the task force, which was composed of educators, business leaders, and community representatives. (MDE 1988)

Minnesota has funded the development of instructional software, curriculum materials using commercial software, and instructional video. Other related efforts have included distance learning projects, courseware integration centers, and equity of access to state and national online communication networks.

Minnesota also continues to fund technology training for educators. These initiatives have helped Minnesota teachers become aware of many applications for technology in education, but the task of training teachers to use information technology as more than a drill and practice machine remains a major problem (Wallin 1989). Effective and appropriate use of information technology has also been identified, by the Minnesota Office of Educational Leadership, as one critical component of a transformed educational system.

In our information society where the only constant could be change, it can no longer be expected that individuals will get an education and be done with it. There is no one education, no one skill, that lasts a lifetime now. The basics of the year 1991 will not be the basics of 2000 (Naisbett 1985). People who are not adequately educated for the present and prepared for life-long learning, possessing the skills essential for the new era, will be effectively disenfranchised from the opportunity to participate fully in the life of the nation. Technological literacy is one of those needed skills.

*Data and information processed into knowledge and wisdom, has become the dominate resource in the United States.*
*People and nations that do not learn to participate in an information-based society may become peasants.*

*Harlan Cleveland*

# Transforming and Restructuring Schools

Statewide efforts in outcome-based education and restructuring schools are not a new vision for many Minnesota educators. These changes have been tried in schools before, at least in modified ways. One reason these changes have not been sustained is because the needed information technology was not available when these changes were tried.

Today that technology exists and is available in Minnesota schools. However, the technology is not being used to its maximum potential. To implement and sustain outcome-based education in a restructured and transformed school system, educators must use the applications of new types of information technology to:

1. manage a complex educational process
2. provide a variety of meaningful learning experiences
3. increase personal productivity by working smarter not harder.

These changes in the use of information technology will require the development of a new vision for the effective use of technology in education, not a new vision for education. Teachers and students need to use the applications of information technology as more than flickering screens of high resolution worksheets.

*Now, as computers and other emerging information technologies take their turn at the schoolhouse door, education has a choice. We can once more take the blame for not being innovative, for not wanting to change, for not caring enough to offer children the very best, or we can learn from our past experiences.*

*Louis Rhodes*

## Beyond Electronic Workbooks

The traditional role of education has been to help students learn a knowledge base of facts. This knowledge allowed them to graduate from formal educational institutions and become effective citizens in our past agricultural and industrial societies. Factual knowledge was power then.

Today information is continually changing. It is no longer enough to learn a finite body of knowledge which rapidly becomes outdated. Schools need to prepare young people to educate themselves throughout their lives. Understanding concepts and information skills is now more important than learning factual knowledge alone.

Information technology now serves as society's storehouse for data. It appears that the essential ability to store, access, process, create, and communicate information with technology will become even more important in the future. Each individual must also be able to efficiently solve problems and have the ability to clearly express those solutions and other creative ideas with technology.

It is time to move to the next plateau of technology use in education. Time to realize information technology is not a separate curriculum taught in isolation from all other subject areas. Education must move beyond using computers as electronic workbooks. Now it is essential to integrate technology applications into all curriculum areas.

Technology has helped bring us into the rapidly changing information society where understanding process is more important than memorizing content. The curriculum must continually be reviewed to determine what is essential for everyone to know and be able to do. Some content will no longer be relevant. The textbook must no longer be the sole source of information. Learners must take a more active role in the learning process and teachers must encourage them to do so.

By taking advantage of the productivity power that new information technology offers, teachers can help students move beyond flickering screens of high resolution worksheets to meet the challenges of our information age. Today's students need to learn using a wider variety of resources which challenge them to think, reflect, and express divergent viewpoints. The focus must be on individual learners and what activities and experiences they need to be successful learners.

Perhaps Eric Hoffer said it best. "In times of change learners inherit the earth, while the learned find themselves beautifully equipped to deal with a world that no longer exists." Information technology, used to its maximum potential, allows teachers to be the best they can be and students to be learners inheriting and managing an ever-changing world.

## Chapter 3

# Outcomes for Information Technology



**K-12 Program Level Outcome**

**Model Learner Outcomes**

# K-12 Program Level Outcome

The research summary in Chapter 2 suggests that a basic skill for all of today's students is technological literacy. In other words, students must have the ability to make information technology do what they want it to do, whenever they want or need technology to do it.

Of course no one really knows what skills will be required in the future. Minnesota's *Model Learner Outcomes for Information Technology* are based on the types of technologies available today and what it could be like in the future. As technology continues to change and improve, the real question to ask is "What do people really need to know about information technology?" The following program level outcome provides a broad answer to that question and is the basis for information technology model learner outcomes.

**Learners will demonstrate the ability to apply diverse technologies to store, access, process, create, and communicate information needed to solve problems or satisfy a personal need.**

This program level outcome is different from those listed in curriculum rule. The Minnesota State Board of Education is currently working to revise the old section of the rule to include this new program level outcome.

> *Helping youngsters develop a commitment to informed decision making, through the ability to locate, process, and use information effectively, is going to be critical to the continuation of democratic societies.*
>
> *John Naisbett*

# Model Learner Outcomes

Graduation outcomes being developed by the Minnesota State Board of Education are expectations of students. The program and model learner outcomes listed in this document are expectations of districts. Written at the concept level, model learner outcomes are to be used by school districts developing integrated information technology curriculum which supports graduation outcomes.

The following model learner outcomes are based on the new program level outcome and State Board of Education Learner Goals identified in Chapter 1. The outcomes are also referenced to the cognitive, psychomotor, and affective development domains. Outcomes that focus on multicultural, gender fair, international, and disability-sensitive issues are coded to indicate this emphasis. In future versions of this document, the learner outcomes may be keyed to items in MIDEBANK®, the Minnesota Department of Education test item bank on CD-ROM.

According to PER legislation and State Board of Education rules, the following model learner outcomes **must be integrated** into each district's curriculum.

| State Board Learner Goals | Learner Outcomes | Concept and Development Emphasis | Item Bank |
|---|---|---|---|
| | **The learner will:** | | |
| A, M | **1. Know basic operations, terminology, and proper care procedures for a variety of information technologies** such as:<br>- computer technology<br>- video technology<br>- audio technology<br>- optical disc technology<br>- traditional audiovisual technology | Knowing<br>Multicultural<br>Gender Fair<br>International | |

| State Board Learner Goals | Learner Outcomes | Concept and Development Emphasis | Item Bank |
|---|---|---|---|
| | **The learner will:** | | |
| A, M | **2. Know appropriate uses of, and strengths and limitations for a variety of information technology applications** such as:<br>- word processing<br>- desktop presenting<br>- hypermedia<br>- desktop publishing<br>- video and audio production<br>- computer-generated graphics and art<br>- music composition software<br>- multimedia production<br>- CAD (computer-assisted design and drafting)<br>- telecommunications/telecomputing | Knowing<br>Multicultural<br>Gender Fair<br>International | |
| M | **3. Know the lifelong learning potential of information technology applications** such as:<br>- computer-assisted instruction<br>- electronic information access<br>- distance learning/telecommunications<br>- productivity software | Knowing<br>Multicultural<br>Gender Fair<br>International | |
| A, B, C, D, F, J, M | **4. Efficiently store, access, and transmit information using applications of a variety of information technology** including:<br>- word processing<br>- desktop presenting<br>- hypermedia<br>- desktop publishing<br>- video and audio production<br>- computer-generated graphics and art<br>- music composition software<br>- multimedia production<br>- CAD (computer-assisted design and drafting)<br>- telecommunications/telecomputing | Knowing<br>Applying<br>Integrating<br>Multicultural<br>Gender Fair<br>International<br>Disability Sensitive | |
| M | **5. Voluntarily apply legal principles and ethical conduct related to information technology** such as:<br>- copyright<br>- plagiarism<br>- telecomputing etiquette | Knowing<br>Applying<br>Integrating<br>Affective<br>Multicultural<br>Gender Fair | |

| State Board Learner Goals | Learner Outcomes | Concept and Development Emphasis | Item Bank |
|---|---|---|---|
| | **The learner will:** | | |
| A, B, C, E, J, M | **6. Effectively communicate creative ideas using a variety of information technology applications** including:<br>- word processing<br>- desktop presenting<br>- hypermedia<br>- desktop publishing<br>- video and audio production<br>- computer-generated graphics and art<br>- music composition software<br>- multimedia production<br>- CAD (computer-assisted design and drafting)<br>- telecommunications/telecomputing | Knowing<br>Applying<br>Integrating<br>Multicultural<br>Gender Fair<br>International<br>Disability Sensitive | |
| A, B, C, F, J, M | **7. Effectively solve and/or present solutions to problems by applying imagery and data management features of a variety of information technology applications** including:<br>- graphing<br>- graphics/art software<br>- databases<br>- spreadsheets<br>- computer programming<br>- CAD/CAM<br>- Lego-Logo<br>- computer simulations<br>- hypermedia<br>- multimedia production<br>- desktop presenting | Knowing<br>Applying<br>Integrating<br>Multicultural<br>Gender Fair<br>International<br>Disability Sensitive | |
| A, M | **8. Thoughtfully develop and articulate positions on attributes of information technology that make it an economic, social, and political resource** such as:<br>- freedom of information issues<br>-the history and impact of information technology on society<br>- the impact of technology on career options<br>- manipulating information/shaping thought<br>- multicultural, gender-fair issues<br>- issues of the physically/mentally challenged<br>- global awareness issues<br>- information as an economic product | Knowing<br>Applying<br>Integrating<br>Affective<br>Multicultural<br>Gender Fair<br>International<br>Disability Sensitive | |

| State Board Learner Goals | Learner Outcomes | Concept and Development Emphasis | Item Bank |
|---|---|---|---|
| | **The learner will:** | | |
| A, B, C, J, M | **9. Consistently apply appropriate information skills needed in order to use information technology effectively** including:<br>- defining information needs<br>- locating sources of information<br>- planning a research strategy<br>- conducting the information search<br>- determining the quality of located information<br>- evaluating and analyzing located information<br>- synthesizing and creating new information<br>- decoding and coding imagery | Knowing<br>Applying<br>Integrating<br>Multicultural<br>Gender Fair<br>International<br>Disability Sensitive | |
| A, C, J, K, M | **10. Successfully transfer previously learned information technology concepts, applications, and skills to new, modified, or related information technology and other curriculum areas** including:<br>- applying common concepts of all word processing applications regardless of input, such as a keyboard, mouse, or voice<br>- applying common concepts of all word processing applications regardless of the program title, such as Appleworks, Microsoft Works, Bank Street Writer, or MultiScribe<br>- using a variety of computer applications regardless of the brand name of the computer which is running the application, such as word processing on an IBM, Tandy, Apple, or Macintosh<br>- connecting and operating the components of any audio, video, or personal computer system, such as the monitor, video tape recorder, compact disc player, and audio receiver of a home entertainment center<br>- selecting appropriate individual or cooperative strategies for using information technology applications effectively<br>- applying content-neutral applications such as word processing, desktop presenting, or hypermedia to complete a task in any school subject | Knowing<br>Applying<br>Integrating<br>Multicultural<br>Gender Fair<br>International<br>Disability Sensitive | |

## Chapter 4

# Transposing Outcomes into Curriculum



What is Technology Integration?

**Integrate Versus Relate**

**How is Technology Integration Accomplished?**

**Modifications and Extensions for Special Populations**

**Developing an Action Plan**

# What is Technology Integration?

***Don't buy technology to teach about technology. We don't have classes called 'pencil,' so why do we have classes called computer literacy?***

***Seymour Papert***

Technology integration is a phrase that appears frequently in literature, but what does it mean for teachers in the classroom? Does it mean that a set number of minutes per day should be devoted to learning with or about technology? Does it mean that technology should be used in every subject area every day? Does using technology mean adding one more thing to the curriculum? The answer to all these questions is "no."

Technology is not a subject to be added to an already overloaded curriculum. It is not, for the most part, an object of study. Rather it is one of the many tools available for teachers to expand, modify, and manage the learning experiences and needs of individual learners.

Of course technologies require at least an introduction before their applications can be used by students. How and where will the teaching of these skills be added to the curriculum? The answer may be that technology-related skills may replace, reduce the emphasis on, or be a more efficient way of learning a subject area skill currently taught. While some technology-related skills may need to be taught, the focus remains on the content-area learner outcome, rather than on the technology itself.

Integration efforts should not be limited to student use of technology, but also stress technology as a tool for teachers. Teachers that are most successful using technology with their students have developed a high degree of comfort using information technology themselves.

Successful technology integration does not mean that computers or other technologies must be used in every subject area every day. **A successful technology integration effort might be characterized by the ability of teachers and students to know *when* technology is the appropriate tool for a task, determine *which* technology should be used, then use that technology to successfully complete the task.** Successful integration also requires that technology needed is available and accessible.

## Integrate Versus Relate

Many schools have been trying to relate information technology to other content areas, but the difference between the terms "relate" and "integrate" are enormous. Relating information technology skills to classroom instruction implies two sets of outcomes which are related but separate. Related instruction could be arbitrarily scheduled or become isolated exercises with little or no meaning to the student.

Integrating information technology skills into the curriculum implies a set of common outcomes, activities, and assessment. Integrated skills are taught by using information technology's applications within a content area to provide meaningful experiences for students. Minnesota Rule 3500.1075 mandates the integration of information technology skills. The same rule also mandates the integration of educational media skills. The *Educational Media Learner Outcomes* also stress integration and may be used along with this document when developing local curriculum.

## How is Technology Integration Accomplished?

While good cases can be made for the need to integrate technology into the educational process, there is a larger question: "How is technology integration accomplished?"

Technology integration is a joint responsibility of classroom, technology, and media teachers, working together as an instructional team, to ensure that each student develops information technology skills. These experiences may occur in the media center, computer laboratory, classroom, television studio, or other instructional areas. It is important that the teaching of information technology skills be integrated with relevant subject topics rather than taught in isolation as a separate, unrelated curriculum. (Dahlbotten 1989)

By integrating technology skills into the curriculum, questions such as "what do I have to stop teaching to teach about the computer?" can be answered. The answer to the question is another question; "What are you teaching now that you could teach more efficiently or effectively with these technical tools?"

The teaching of writing provides an excellent example of how to use applications of information technology in the curriculum. Word processing and desktop publishing are applications of technology that teachers can use to help students share creative thoughts and communicate effectively with others. The goal is teaching writing skills, but now with powerful information technology applications, not pencils.

## Modifications and Extensions for Special Populations

Trends in education and legislation are providing the opportunity for exceptional students to benefit from information technology outcomes. As we strive to include individuals who represent special populations, consideration should be given to the needs and services that make it possible for full participation in the education system.

In the Individuals with Disabilities Education Act (IDEA) direction is provided to encourage more emphasis in the use of technology by defining both assistive technology services and devices. Assistive technology service is defined as ***any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device.*** An assistive technology device is defined as ***any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities.***

The key to effective use of technology is to provide the appropriate access tools so that students with disabilities may compete and succeed in education. Effective access to technology is made possible when essential modifications or adaptations include considerations for computer input issues, computer output issues, documentation options and environmental modifications. Adaptations or modifications required are determined by the type and severity of an individual persons needs. Successful inclusion in the information technology outcome process will be based on the degree to which resources are used to bridge the gap between goals and access requirements so that the person can achieve according to his/her ability.

For students that are gifted or talented, effective use of technology requires matching individual students with appropriate instructional applications and activities. This requires in-depth knowledge of the student's educational needs, preferred learning style, the outcomes to be accomplished, the logical extensions or enrichments needed, and the method of delivery.

*For most people, a computer makes things easier. For people with disabilities it can make the impossible possible.*

*Brita Meng*

# Developing an Action Plan

At the district level, successful technology integration efforts are characterized by:

- a vision for the future
- a plan for integrating technology into the content areas
- ownership and commitment by the teachers
- support from the school board, administration, and community
- appropriate staff development opportunities
- availability of hardware, software, support personnel, and related resources

Technology plans should not only address a vision, but also assess the district's current situation with respect to technology and identify processes for implementation. The plan should also:

- identify needs
- develop a rationale for change
- identify content areas and grade levels where technology learner outcomes will be achieved
- clarify responsibilities for achieving outcomes
- provide a measure of accountability
- address short- and long-term staff development issues
- address funding and other resource issues
- address racial, gender, and other social equity issues
- set long- and short-term goals
- provide for communication of goals and progress
- provide for continuous review and evaluation
- have capability for modification

Flexibility is a key element of any educational plan, especially since the future may be thought of as a moving target. Any plans involving technology should be flexible enough to take advantage of a constant evolution of capability, function, and pricing of information technology.

There are no clearly defined recipes for technology integration that will work for every school district. A successful technology integration effort for one school district may serve as a model for another district, but the process of developing the plan, with input from those who will implement the plan, is essential for success. While there may be many similarities, differences in staff, administration, community attitudes, and resources may dictate different methods of achieving desired outcomes.

Technology integration efforts should not be characterized by efforts to infuse technology into an existing curriculum in artificial ways. Rather, educators should thoughtfully start with "what ought be" and move to "what is." Starting with "what ought to be" allows for fresh and innovative thinking. Starting with "what is" and concentrating only on present problems often locks planning committees into demoralizing thinking.

Identify ways that technology may be used as a tool to empower students and teachers, extend opportunities for learning, and take advantage of research on learning;

Seek to define the knowledge and skills, and literacy necessary to lead full, rich, and productive lives;

Ask, "If everything were working well, what kind of students would we be producing?" Brainstorm a list of desirable student traits and use it to help develop learner outcomes;

Ask, "In an ideal world, what would have to be in place in the school district to achieve these desirable outcomes?" Brainstorm a list and use it to develop categories for a comprehensive information technology plan.

*Computers, video discs, CD-ROM, and other information technologies have the marvelous capacity to store and present huge amounts of detailed, trivialized data. If our use of these technologies is to force students to memorize and spew out more unrelated, lower-level answers then they are already forced to, then our technology efforts will have made education worse, not better.*

*Dr. Gilbert Valdez*

# Resources

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**Additional Materials**

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*Beyond the Electronic Workbook* is the companion videotape to this publication. Minnesota schools may receive a free copy of *Beyond the Electronic Workbook*, by sending a blank VHS videotape, with a written request to:

Lynn Cherrier
Media and Technology Unit
605 Capitol Square Building
550 Cedar Street
St. Paul, MN 55101

Other publications and materials on technology integration and use are also available. Minnesota schools may receive free copies. For more information, to schedule local workshops or consultations, please contact:

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